Multilevel ICT design to support education and learning: Theory and practice

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Overview

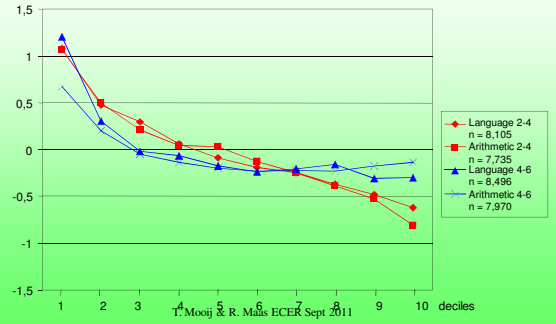
1. Introduction
2. Multilevel theory
3. Method:
   - development research
   - experimental research
4. First results
5. Discussion

1. Introduction

Differences between pupils per competence / school subject area

	Low	Middle	High
Beginning level	Lower		Higher
Learning steps	Smaller		Greater
Motivation	Concrete		Abstract
Structuring	Task-based		Creative
Working period	Shorter		Longer
Repetition	With variation		New
Coaching	More often		Less often
Self-regulation	Less		More

Differences z-scores 2004-2002 Grades 2-4 (red) and 4-6 (blue)



Longitudinal cohort high ability pupils

Causal effects 2002-2004:
- class size: larger number pupils in class, negative effects
- age-based monitoring: negative effects
- class mean performance: higher mean, negative effects

Teacher's functioning 2002 – 2004:
- acceleration: skipping grade(s) positive effects on motivation and behaviour in class, and on cognitive performance

Research question

HOW TO SUPPORT LEARNING PROCESSES OF PUPILS WITH DIFFERENT ABILITIES, INCLUDING SELF-REGULATION ABILITIES, TO REALISE THAT ALL CAN ACHIEVE ACCORDING TO THEIR POTENTIALS IN PRESCHOOL - PRIMARY SCHOOL?

2. Multilevel theory

Various types of variables
education, instruction, learning, personal
individual, group, school levels
interactions at / between levels
resulting in specific but related
multilevel longitudinal
processes and effects

Learning psychology at pupil level: Self-regulation and learning tasks

Zimmerman (2000):

Self-regulation: self-generated thoughts, feelings, and actions that are planned and cyclically adapted to the attainment of personal goals

Competence-based learning:

- estimation of difficulty level of task - selection
- types of support or coaching of task execution
- assessment or evaluation of results

Systemic design to improve education and learning

Educational contextual dimensions:

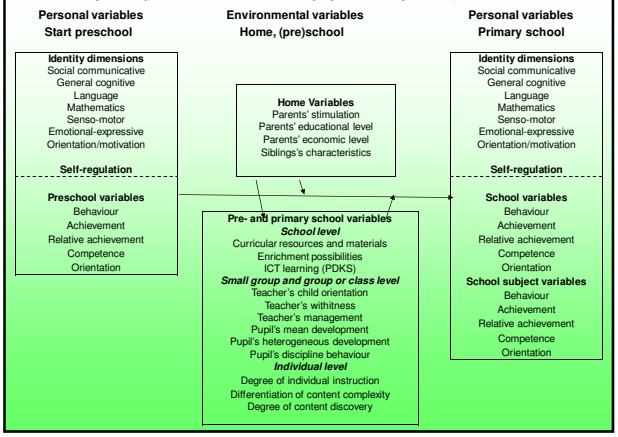
- Differentiation of learning materials and procedures
- Integration by and use of ICT support (in multilevel ways)
- Strategies to improve development and learning
  - Beginning char., prosocial rules, small groups, self-regulation

Four aspects of learning processes:

- Diagnostic, instructional, managerial, systemic

Combining dimensions and aspects: Optimal education

Pre- and primary school influences on pupil development (three-level model)



Hypothesis

Compared with their learning in traditional education,
in optimal education – learning conditions
both low and high ability pupils will improve
their social, emotional and cognitive learning processes
in particular because of the adequate integration
of these pupils' self-regulatory capacities
in the instructional designs.

3. Method

Projects 'contextual learning model'

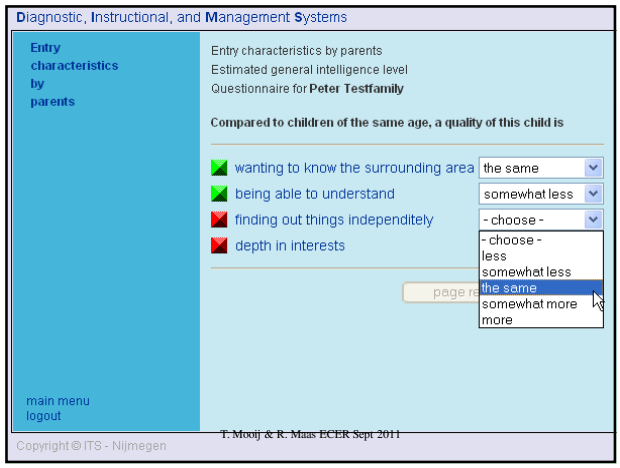
- Development of prototype Pedag. Did. Kernel Structure
- Screening of beginning characteristics
- Development of prototype software
- Pilots in preschool / primary school
- Collaborative research and development in practice
- Two experimental longitudinal projects

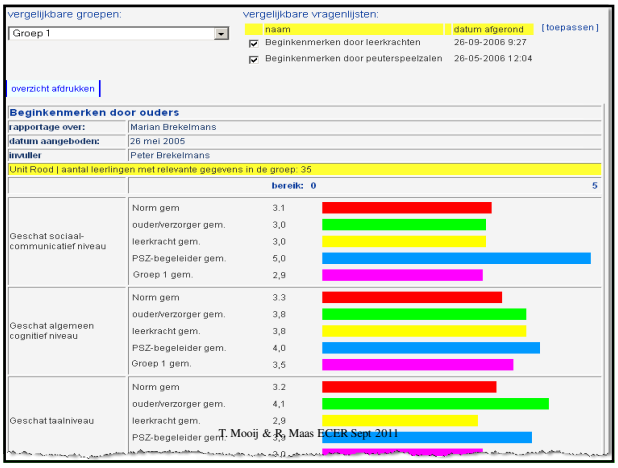
4. First results

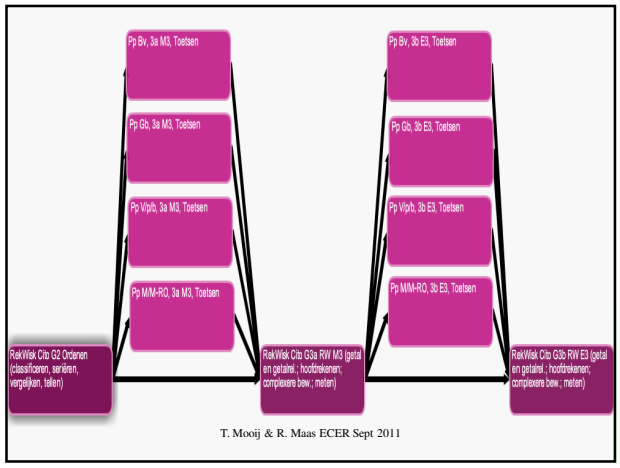
Pedagogical-Didactic Kernel Structure

Competence domains:

- language
- general - cognitive
- social - emotional
- arithmetic / mathematics
- physical - medical
- general - psychological
- motor







Implementation

Pilots in preschool and primary school

- collaboration with pre- / primary school teachers
- screening of beginning characteristics four-year olds
- experiences in practice:
  - collaboration between parents and teachers
  - multi-perspective communication about competence levels
  - introduction of appropriate levels of play / learning materials
  - further specific educational support in prosocial small groups

Reliabilities screening scales, per type of respondent

	Day-care		Parents		Preschool	
Screening scales (number items)	N	Alpha	N	Alpha	N	Alpha
Social-communicative level (2)	52	.97	134	.97	118	.91
General cognitive level (4)	51	.87	133	.62	117	.82
Language proficiency level (5)	34	.97	113	.82	106	.86
Pre-arithmetic level (4)	30	.89	119	.84	109	.92
Emotional-expressive level (5)	45	.87	131	.87	116	.82
Sensorimotor level (4)	50	.88	124	.77	109	.81
Expected educ. behave./motiv. (4)	48	.93	131	.83	116	.85

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Differences in mean scores

	Mean[a]			Mean[b]			Mean[c]		
Screening scales	Day-care	Par-ents	T[d]	Day-care	Pre-school	T[d]	Par-ents	Pre-school	T[d]
Social-communicative	3.43	3.32	-.62	3.43	3.41	-.15	**3.18**	**3.46**	**-3.49****
General cognitive level	3.60	3.57	-.32	3.60	3.53	-.59	3.52	3.63	-1.91
Language proficiency	3.28	3.41	1.24	3.28	3.44	1.48	3.39	3.49	-1.58
Pre-arithmetic level	3.24	3.36	1.12	**3.22**	**3.55**	**2.93***	**3.36**	**3.52**	**-2.76***
Emotional-expressive	3.43	3.67	1.82	3.42	3.55	1.43	3.50	3.56	-1.14
Sensorimotor level	**3.48**	**3.20**	**-2.33***	**3.48**	**3.24**	**-2.23***	**3.23**	**3.37**	**-2.41***
Exp. educ. beh./motiv.	3.51	3.45	-.58	3.52	3.57	.49	**3.39**	**3.58**	**-3.38****

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5. Discussion

1. Self-regulation of pupils and criterion-based education and learning
2. Self-regulation of pupils and norm-based pupil monitoring
3. School-based innovation, ICT at multiple levels, and self-regulation of school teams

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